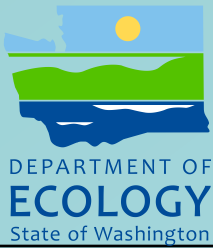




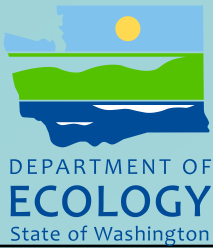
Mandatory Reporting of Greenhouse Gas Emissions
for On-Road Motor Vehicles in Washington State
January, 2009



Workshop Disclaimer

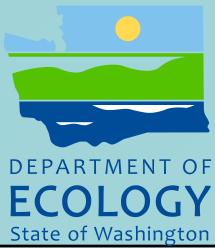
- This workshop is on reporting greenhouse gas emissions in Washington for fleets of on-road motor vehicles
- Reporting for stationary sources or other mobile sources such as aircraft, boats, trains, and off-road vehicles will not be covered
- See the following website for more information regarding reporting of those sources:

http://www.ecy.wa.gov/programs/air/globalwarm_RegHaze/GreenHouseGasreporting_rule.html



Workshop Agenda

- Overview of Greenhouse Gas (GHG) Programs
 - Washington GHG program
 - Other regional and national GHG programs
 - Regulation elements
- Fleet reporting – step by step what needs to be done
 - What needs to be reported
 - How to calculate emissions
 - How to report
 - Department of Ecology fleet emissions as example
- Questions and Discussion
 - Sources for more information



Overview of Greenhouse Gas Programs

- Washington State GHG policy and legislation
- Western Climate Initiative (WCI)
- The Climate Registry (TCR)
- Federal GHG Program



Washington GHG Policy and Legislation

- Governor Gregoire- Executive Order 07-02
 - Established GHG reduction goals
- HB 2815 passed in 2008 legislative session
 - Adopted the 2007 GHG reduction goals
 - Required Ecology to adopt rules for mandatory reporting of GHG emissions
- Founding member of the Western Climate Initiative
 - Partnership with other states to regionally reduce GHG emissions

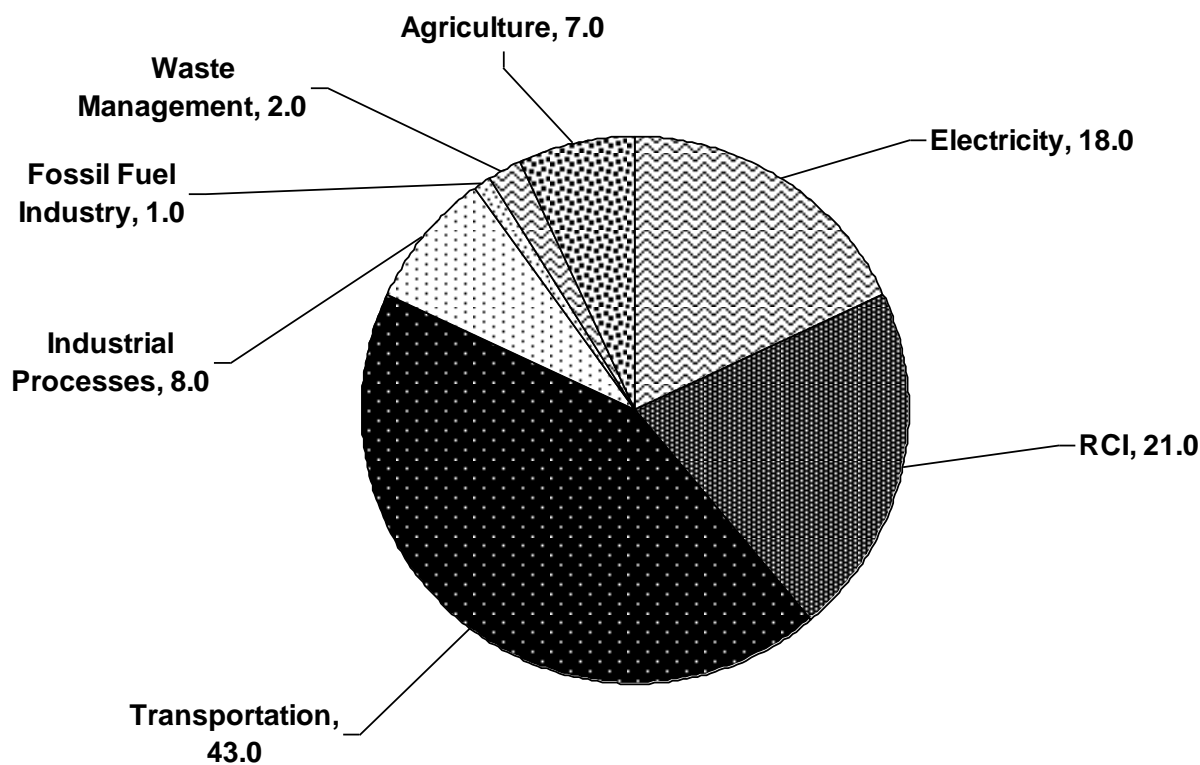


Washington State GHG Emissions Reduction Goal

- **By 2020** reduce GHG emissions to 1990 levels
- **By 2035** reduce emissions to 25% below 1990 levels
- **By 2050** reduce emissions to 50% below 1990 levels

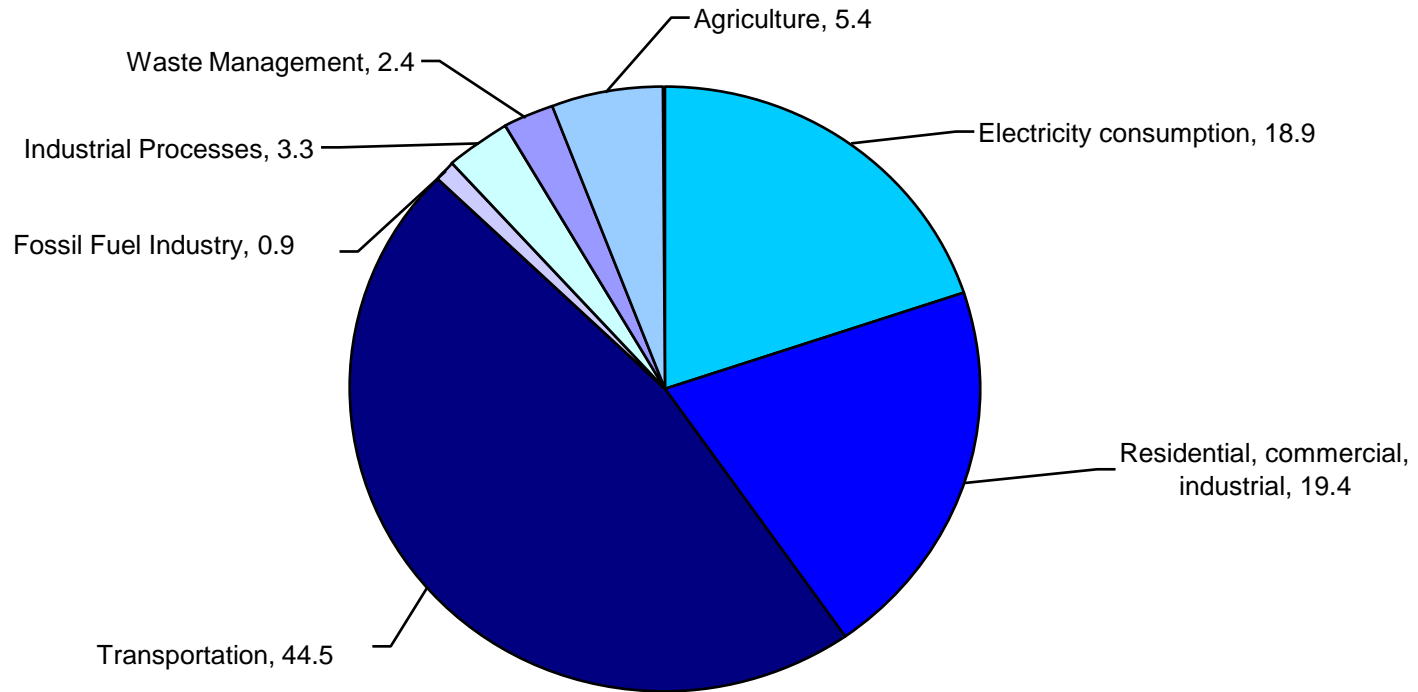
1990 Baseline – 88.4 MMT CO₂e

% Contribution to 1990 GHG Emissions

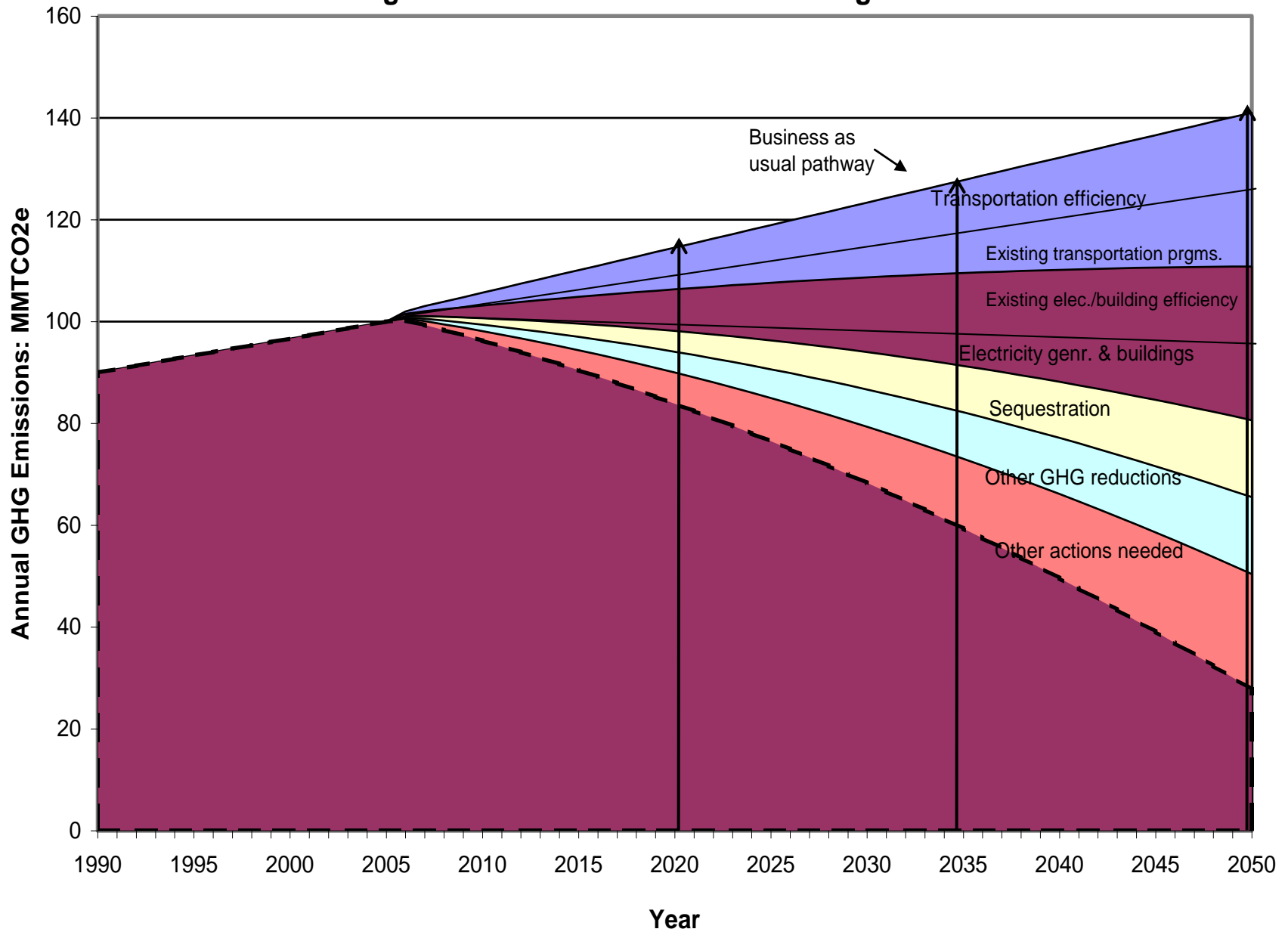


Washington State -2005

WA State 2005 GHG Emissions by Sector (94.8 MMT)



Washington GHG Emission Reduction Wedges: 2005-2050





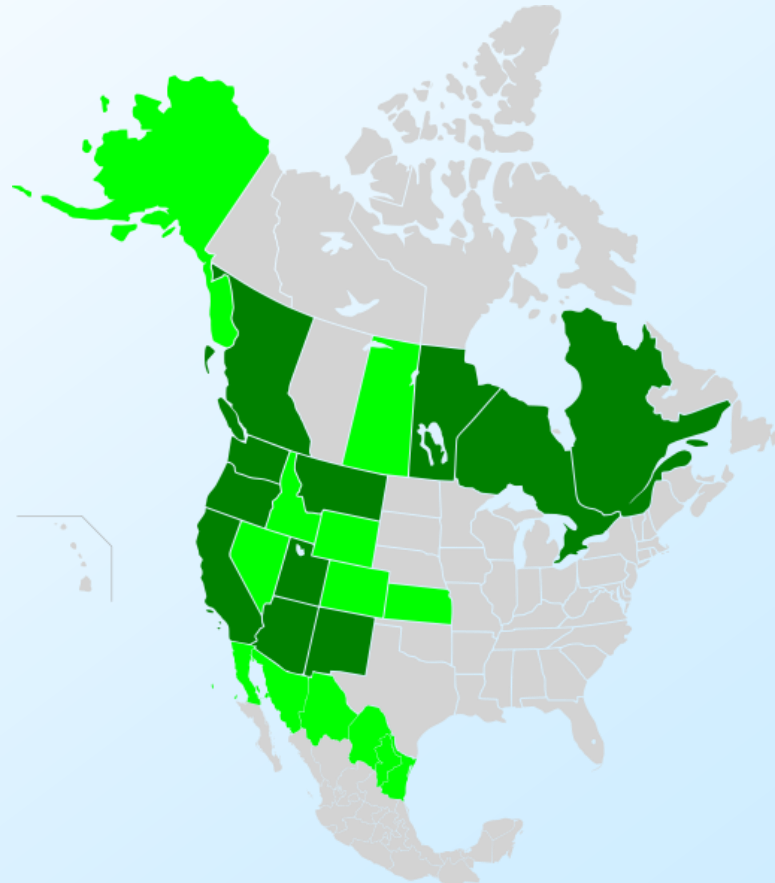
HB 2815 – GHG

Mandatory Emissions Reporting

- Applies to stationary sources, mobile sources and on-road fleets
- Requires that persons report 2009 emissions starting in 2010
- Allows ECY to phase in reporting for stationary sources until January 1, 2012
- ECY can charge a fee for GHG reporting

Western Climate Initiative (WCI)

- February 2007 – Governors of Washington, Oregon, California, Arizona and New Mexico
 - Develop regional strategies to address climate change
- Montana, Utah, British Columbia, Manitoba, Ontario and Quebec have since joined as partners
- More information:
<http://www.westernclimateinitiative.org>



Western Climate Initiative (WCI)

- Identify, evaluate, and implement collective and cooperative ways to reduce greenhouse gases in the region, focusing on a market-based cap and trade system
- Coordinates and recommends policy, but all decisions must be ratified by states
- Currently developing reporting and cap and trade protocols

The Climate Registry

- 299 members (Dec 2008)



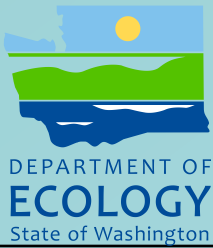


The Climate Registry (TCR)

- Nonprofit organization specializing in GHG reporting, data management, and calculation methodologies
- Goal is to establish a common GHG inventory system for North America
- Members include: 40 states, 12 Canadian provinces, and six Mexican states
- Working closely with WCI, Washington, and other states to provide support for mandatory reporting programs
- Washington plans to use TCR to help develop and maintain database – increases quality and consistency with other states while reducing cost and development time
- More information: <http://theclimateregistry.org>

Federal GHG Program

- Currently no federal GHG program
- Potential for a federal cap & trade or carbon tax system
- EPA started developing a GHG reporting rule in 2008, but currently on hold
- Washington's statute encourages compatibility with any future federal program
 - Required to be consistent, but not identical
- More information:
<http://www.epa.gov/climatechange/emissions/ghgrulemaking.html>



Elements of Washington State GHG Regulation

1. Threshold determination
2. Direct emissions
3. Reporting On-road fleets
4. Emissions to report
5. Organizational boundaries
6. Deferred interstate emissions
7. Calculation methods
8. Simplified estimation methods
9. Data submittal
10. Verification
11. Fees

1. Reporting Thresholds

I. Fleets of on-road motor vehicles

- **2,500 metric tons CO₂ equivalents / year**
 - ~ 280,000 gallons gasoline
 - ~ 240,000 gallons diesel

or

II. Source or combination of sources of direct emissions

- 10,000 metric tons of CO₂ equivalents / year
- (if this threshold is triggered then all annual emissions must be reported, including indirect emissions)

2. Direct Emissions from Mobile Sources

Direct emissions:

- Mobile combustion of fuels:
 - Fleet tailpipe emissions
 - Carbon dioxide, methane, nitrous oxide
- Fugitive emissions
 - HFC's from air conditioning units

Only direct emissions count towards triggering the reporting threshold

Indirect emissions:

- Associated with the purchase of electricity, heating, cooling, or steam
- Not commonly part of fleet operations
- Plug-in electric cars
- Do not count towards threshold determination, but must report once over threshold

3. Reporting On-Road Fleets

An owner or operator of:

- Passenger cars, SUVs, vans, buses, trucks, and other motor vehicles that operate on roads in Washington and
- Meets the 2500 MT reporting threshold

Does not include:

- Other mobile sources: aircraft, boats, trains, off-road vehicles, heavy construction equipment, and vehicles that operate within a single facility

NB: These emissions would be included in the 10,000 MT threshold assessment.

4. Emissions to Report

- Greenhouse gases include:
 - Carbon Dioxide (CO₂)
 - Methane (CH₄)
 - Nitrous Oxide (N₂O)
 - Hydrofluorocarbons (HFC's)
 - Perfluorocarbons (PFC's)
 - Sulfur Hexafluoride (SF₆)
- Biomass / Biofuel - burning of biomass / biofuel must be reported separately from the burning of fossil fuels

5. Organizational Boundaries

- HB 2815 requires the owner/operator to report total emissions of GHGs
- Organizational Boundary:
 1. Operational control – including leases
 2. Ownership
 - Must use method consistently

6. Deferred Interstate Emissions

“The Department may defer the reporting requirement under

(a) of this subsection for emissions associated with interstate and international commercial aircraft, rail, truck, or marine vessels until

(i) there is a federal requirement to report these emissions; or

(ii) the department finds that there is a generally accepted reporting protocol for determining interstate emissions from these sources.”

7. Calculation Methods

- Set by the rule
- Based on TCR and WCI methodologies
 - Tied to other national and international standards
- Tiered system, most emission sources have multiple calculation methods to choose from
- This workshop will go over simplest method for fleet calculations

8. Simplified Estimation Methods

- A simplified approach to calculate small emissions
- Use TCR as a guideline
 - <http://www.theclimaterestry.org/downloads/GRP.pdf>
 - Chapter 11, pg 58
- Up to 5% of total emissions or 10,000 MT CO₂e, whichever is less
 - These values could change subject to WCI protocol
 - On a fleet basis

9. Data Submittal

- Report to Ecology
 - No separate reporting to Local Air Authorities
- Plan to use TCR platform for data management
 - Online submittal
 - Will include some calculation features
- Emissions must be reported annually
 - Calendar year - January 1st to December 31st
- Reports must be self-certified and submitted by
 - October 31st of the following year
 - 2009 emissions must be reported by October 31st , 2010

10. Data Verification

- Necessary to insure that the GHG emissions data are accurate
- On-road motor vehicle fleets and small stationary sources will be allowed to use self certification
- Ecology will provide oversight and enforcement

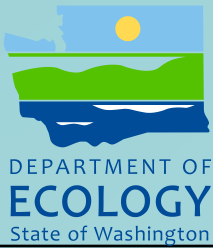
11. Reporting Fees

RCW 70.94.151 authorizes Ecology to charge a fee:

- “The department... may require that such ...reporting be accompanied by a fee, and may determine the amount of such fee...PROVIDED, That the amount of the fee shall only be to compensate for the costs of administering such...reporting program”
- Fee amount not yet determined – need cost estimate
- Fee proportional to emissions quantity and facility complexity



How to Calculate Emissions



Fleet Reporting Steps

1. Determine organizational boundaries
2. Limit to in-state travel
3. Collect data
4. Separate biogenic emissions
5. Calculate emissions
6. Interpret results
7. Self certification
8. Submit report

Example using Department of Ecology emissions



Step #1: Determine Organizational Boundaries

- Determined by what your organization has operational control over
- Subsidiaries roll up to parent organization
- Organization determined to have control of source reports 100% of emissions from that source even if control or ownership is shared with other organizations
- If operational control cannot be determined for a source, owner reports
- Up to organization to establish boundaries, but Ecology has final determination

Operational Control

- One or more of the following conditions can establish operational control:
 - Authority to introduce and implement operational policies
 - Holding an operating license usually gives this authority
 - Holding environmental licenses or permits for the source
 - Wholly owning an operation, facility or source

Operational Control Examples

- Car dealership leasing vehicle to private party for multiple years
 - Private party responsible
- Car rental organization rents vehicle to private party for short term
 - Rental company responsible
- Bus fleet contracts services to school district
 - Bus fleet contractor responsible – typically...

Organizational Boundaries: Ecology

- Ecology owns and operates fleet
- All on-road motor vehicles in state
 - Combine vehicles from all regional offices
 - Boats and other non-road mobile sources not included

Step #2: Limit to In-State Travel

- Only count emissions that occur in Washington state
- All vehicles under in your organizational boundaries that operate in Washington are part of your fleet
- Determined by fuel purchases
- If fuel purchase information unavailable, determine by mileage or base location
- Method must be consistent



In-State Emissions: Ecology

- Practically all agency travel in-state
- Report 100%

Step #3: Collect Data

- Will need:

- Total amount of fuel purchased in Washington
- Fuel values must be reported separately by fuel type: gasoline, diesel, natural gas, biodiesel, etc
- Number of vehicles with air conditioning units
- Number of decommissioned AC units

- If necessary:

- Fuel and/or refrigerant use information for any back of truck generators, cooling systems, or other devices



Data Collection: Ecology

Fuel Type	Number of Vehicles	Gallons Used	Miles Driven
Gasoline	433	202,380	4,073,514
Diesel	14	9,854	144,703
Biodiesel	1	430	5,359
CNG	1	14,900 scf	5,189
Total	449	212,664 + 14,900 scf CNG	4,228,765

Step #4: Separate Biogenic Emissions

- If biogenic portion of fuel is greater than 50%, multiply fuel volume by percentage and report as separate fuels
 - Example: 1,000 gallons of 80% biodiesel, 20% diesel mix: reported as 800 gallons biodiesel, 200 gallons diesel
- If biogenic portion of fuel is less than 50%, reporter can choose to report by percentage or report all fuel use as fossil fuel
 - Example: 1,000 gallons of 80% diesel, 20% biodiesel mix: reported as 1,000 gallons diesel

Biogenic Fuel: Ecology

Fuel Type	% Biogenic	Fuel Purchased (gal)	Adjusted Fuel Use (gal)
Gasoline	0	202,380	202,380
Diesel	0	9,854	9,940
Biodiesel	80	430	344
CNG	0	14,900 scf	14,900 scf

Assume 20% of biodiesel is petrodiesel.

Step #5: Calculate Emissions

- Multiple methods to choose from – outlined in TCR GRP
- Tiered system of varying complexity
- Required data depends on method
- Each gas calculated separately

Tiers

CO₂ Emissions

Tier	Data	Factor
A1	Fuel use	<ul style="list-style-type: none"> ● Measured carbon content and fuel density or ● Measured carbon content and heat content
A2	Fuel use	<ul style="list-style-type: none"> ● Measured heat content and default carbon content or ● Measured carbon content and default heat content
B	Fuel use	Default factors by fuel type
C	Fuel use estimated by mileage	Default factors by fuel type

CH₄ & N₂O Emissions

Tier	Data	Factor
A	Mileage	Default factors based on vehicle type and technology
B	Mileage	Default factors based on vehicle type and model year
C	Mileage estimated by fuel use	Default factors based on vehicle type and technology or model year

Step #5: Calculate Emissions

- Basic and most common method covered here:
 - CO₂: Tier B – fuel use and default emission factors
 - CH₄ and N₂O: simplified estimation method
 - HFCs: TCR screening method
- Ecology will provide calculation tool for basic method
- Methods available for organizations that only track mileage
- Report submission form will calculate all tiered methods

Carbon Dioxide Equivalents

- Carbon dioxide equivalent (CO_{2e}) – The universal unit for comparing emissions of different GHGs expressed in terms of the global warming potential (GWP) of one unit of carbon dioxide

Global Warming Potential

The ratio of the heat trapping ability of each greenhouse gas relative to that of carbon dioxide. e.g. one metric ton of methane has 21 times more ability to trap heat in the atmosphere than one metric ton of carbon dioxide.

Greenhouse Gas	GWP
CO ₂ - carbon dioxide	1
CH ₄ - methane	21
N ₂ O - nitrous oxide	310
HFCs - hydrofluorocarbons	12-11,700
PFCs - perfluorocarbons	6,500-9,200
SF ₆ - sulfur hexafluoride	23,900

CO₂ Calculation Method

- CO₂: Tier B – fuel use and default emission factors
- From TCR GRP Chapter 13: Direct Emissions from Mobile Combustion
- Other methods require more data including:
 - Measured fuel characteristics (carbon and/or heat content)
 - Mileage and fuel economy of each vehicle

TCR Tier B CO₂ Emission Factors

Table 13.1 U.S. Default CO₂ Emission Factors for Transport Fuels

Fuel Type	Tier A2 Method			Tier B/C Method
	Carbon Content (Per Unit Energy)	Heat Content	Fraction Oxidized	CO ₂ Emission Factor (Per Unit Volume)
Fuels Measured in Gallons	kg C / MMBtu	MMBtu / barrel		kg CO ₂ / gallon
Motor Gasoline	19.33	5.218	1.00	8.81
Diesel Fuel No.1 and 2	19.95	5.825	1.00	10.15
Aviation Gasoline	18.87	5.048	1.00	8.32
Jet Fuel (Jet A or A-1)	19.33	5.670	1.00	9.57
Kerosene	19.72	5.670	1.00	9.76
Residual Fuel Oil (#5,6)	21.49	6.287	1.00	11.80
Crude Oil	20.33	5.80	1.00	10.29
Biodiesel (B100)*	NA	NA	1.00	9.46
Ethanol (E100)*	17.99	3.539	1.00	5.56
Methanol**	NA	NA	1.00	4.10
Liquefied Natural Gas (LNG)*	NA	NA	1.00	4.46
Liquefied Petroleum Gas (LPG)*	17.23	3.849	1.00	5.79
Propane	17.20	3.824	1.00	5.74
Ethane	16.25	2.916	1.00	4.14
Isobutane	17.75	4.162	1.00	6.45
n-Butane	17.72	4.328	1.00	6.70
Fuels Measured in Standard Cubic Feet	kg C / MMBtu	Btu / Standard cubic foot		kg CO ₂ / Standard cubic foot
Compressed Natural Gas (CNG)*	14.47	1,027	1.00	0.054

Source: U.S. EPA, *Inventory of Greenhouse Gas Emissions and Sinks: 1990-2005* (2007), Annex 2.1, Tables A-31, A-34, A-36, A-39, except those marked * (from EPA Climate Leaders, Mobile Combustion Guidance, 2007) and ** (from California Climate Action Registry *General Reporting Protocol* Version 2.2, 2007, Table C.3). A fraction oxidized value of 1.00 is from the IPCC, *Guidelines for National Greenhouse Gas Inventories* (2006). Note: Default CO₂ emission factors are calculated using Equation 12d: Heat Content × Carbon Content × Fraction Oxidized × 44/12 × Conversion Factor. Heat content factors are based on higher heating values (HHV). NA = data not available.

Step #5a: CO₂ Calculations

Fuel Type	Adjusted Fuel Use (gal)	Emission Factor (kg CO ₂ / gal)	CO ₂ Emissions (CO ₂ e)
Gasoline	202,380	8.81	1,783
Diesel	9,940	10.15	101
Biodiesel	344	9.46	3
CNG	14,900 scf	0.054	1
Total	NA	NA	1,888

- Adjusted Fuel Use x Emission Factor / 1,000 = CO₂ Emissions
- CO₂ Emissions x GWP = CO₂e Emissions
- GWP for CO₂ = 1

CH₄ and N₂O Calculation Method

- Simplified estimation method – if under 5% of total emissions can use this method or develop your own rigorous method
- Adapted from 2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol.2 Table 2.2
- Other methods require more data including:
 - Mileage of each vehicle
 - Individual vehicle emissions control technology or model year
 - Fuel economy for each vehicle



Simplified Estimation Method

CH₄ and N₂O Emission Factors

Fuel	CH ₄ Factor (kg/TJ)	N ₂ O Factor (kg/TJ)	Heat Content (mmBTU / bbl)
Gasoline	3	0.6	5.23
Diesel	3	0.6	5.83
Biodiesel	3	0.6	5.36
Ethanol	3	0.6	3.54
Liquefied Petroleum Gas (LPG)	1	0.1	3.86
Propane	1	0.1	3.83
Butanol	1	0.1	4.33
Compressed Natural Gas (CNG)	0.9	0.1	1027 (BTU/scf)

Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol.2 Table 2.2 (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf)

Step #5b: CH₄ Calculations

Fuel Type	Adjusted Fuel Use (gal)	Emission Factor (kg CH ₄ / TJ)	Heat Content (mmBTU / bbl)	CH ₄ Emissions (CO ₂ e)
Gasoline	202,380	3	5.23	1.7
Diesel	9,940	3	5.83	0.1
Biodiesel	344	3	5.36	0.0
CNG	14,900 scf	0.9	1027 (BTU/scf)	0.0
Total	NA	NA	NA	1.8

- CH₄ Emissions = Adjusted Fuel Use x Emission Factor x Heat Content x 2.51x10⁻⁸
- For CNG: CH₄ Emissions = Adjusted Fuel Use x Emission Factor x Heat Content x 1.05x10⁻¹²
- CO₂e Emissions = CH₄ Emissions x GWP
- GWP for CH₄ = 21

Step #5c: N₂O Calculations

Fuel Type	Adjusted Fuel Use (gal)	Emission Factor (kg N ₂ O / TJ)	Heat Content (mmBTU / bbl)	N ₂ O Emissions (CO ₂ e)
Gasoline	202,380	0.6	5.23	4.9
Diesel	9,940	0.6	5.83	0.3
Biodiesel	344	0.6	5.36	0.0
CNG	14,900 scf	0.1	1027 (BTU/scf)	0.0
Total	NA	NA	NA	5.2

- N₂O Emissions = Adjusted Fuel Use x Emission Factor x Heat Content x 2.51×10^{-8}
- For CNG: N₂O Emissions = Adjusted Fuel Use x Emission Factor x Heat Content x 1.05×10^{-12}
- CO₂e Emissions = CH₄ Emissions x GWP
- GWP for N₂O = 310

HFC Emissions

- “Tier D” – TCR GRP Screening Method
 - TCR considers simplified estimation method, but Ecology will accept it as a tiered method
 - TCR GRP Chapter 16, pg 128–131
- Most fleets will only need vehicle use portion of equation
 - New equipment – only if new AC unit is not pre-charged with refrigerant
 - Equipment being disposed of – only if AC unit is being scrapped, not if vehicle / unit sold or leased

HFC Calculations

- AC use = $1.5 \text{ kg} \times 20\% \times 1 \text{ year} = 0.3 \text{ kg / unit}$
- $0.3 \text{ kg / unit} \times 449 \text{ vehicles with units} = 134.7 \text{ kg / 1,000} = 0.1347 \text{ MT HFCs}$
- HFCs = HFC-134a, GWP = 1,300
- $0.1347 \text{ MT HFCs} \times 1,300 = 175 \text{ MT CO}_2\text{e}$

Other Emissions

- Back of truck units
 - Refrigeration systems
 - Generators
 - TCR GRP methods – Chapters 16 or 12
 - Calculate and add to total direct emissions
- Many fleets will not have these emission types

Total Direct Emissions

	Fossil Fuel MT CO ₂ e	Biogenic MT CO ₂ e	Total MT CO ₂ e
CO ₂	1,885	3	1,888
CH ₄	1.8	NA	1.8
N ₂ O	5.2	NA	5.2
HFCs	175	NA	175
Total	2,067	3	2,070



Emissions Calculator

Washington State Department of Ecology Greenhouse Gas On-Road Motor Vehicles Emissions Calculator

Instructions:

Enter total amount of fuel used by fleet in Washington state. For fleets that travel out of state, fuel use is determined by purchase location. If biogenic % is unknown, use 99% for biodiesel, 85% ethanol, and 0% for all other fuels. Fuel quantities are in gallons except for CNG which is in scf. For fugitive emissions enter number of vehicles in fleet with air conditioning units. AC units are only considered decommissioned if the unit is scrapped, vehicles sold or returned to leasing company do not count. Emissions from other equipment and fugitive sources must be calculated separately.

Fuel Use

	Fuel Purchased	Biogenic Content
Gasoline:	<input type="text"/> gallons	<input type="text"/> 0%
Diesel:	<input type="text"/> gallons	<input type="text"/> 0%
Biodiesel (B100):	<input type="text"/> gallons	<input type="text"/> 99%
Ethanol (E100):	<input type="text"/> gallons	<input type="text"/> 85%
Liquefied Petroleum Gas (LPG):	<input type="text"/> gallons	<input type="text"/> 0%
Propane:	<input type="text"/> gallons	<input type="text"/> 0%
Butanol:	<input type="text"/> gallons	<input type="text"/> 0%
Compressed Natural Gas (CNG):	<input type="text"/> scf	<input type="text"/> 0%

Air Conditioning:

	AC Units
Vehicles in Fleet with AC Units:	<input type="text"/>
Number of AC Units Decommissioned:	<input type="text"/> 0

calculate

Step #6: Interpret Results

- Determine if over threshold
- If 2,500 MT CO₂e threshold exceeded, report emissions
- Check for and correct errors

Step #7: Self Certification

- Report all Washington emissions for vehicles within your organizational boundaries
- Verify all methods, data, and calculations are accurate
- Complete certification statement on report

Step #8: Submit Report

- Submit complete, self certified report
- Due by October 31st of each year for proceeding year's emissions

Report Web-form

CRIS: Climate Registry Information System - Windows Internet Explorer

http://64.106.211.231/eats/tcr_test/index.cfm?hc=IiLOOCAK

CRIS: Climate Registry Information System

Fuel Consumed * Gasoline (Motor Gasoline)

Quantity * 1000 gallons

Oxidation Factor 1

Calculate

CO2 (Carbon dioxide) **CH4 (Methane)** **N2O (Nitrous Oxide)**

Greenhouse Gas CO2 (Carbon dioxide)

Default Formula $[Quantity] \times [Emission\ Factor] \times [Oxidation\ Factor] / 1000$

Do you wish to customize these values? ☐

CH4 (Methane)

CO2 (Carbon dioxide)

N2O (Nitrous Oxide)

Back **Save Draft Emissions**



More Information

- Ecology's GHG Reporting Rule webpage:

http://www.ecy.wa.gov/programs/air/globalwarm_RegHaze/GreenHouseGasreporting_rule.html

- Fleet reporting workshop materials:

http://www.ecy.wa.gov/programs/air/globalwarm_RegHaze/GHGonroadworkshops.htm

- Rule stakeholder meeting webpage:

http://www.ecy.wa.gov/programs/air/globalwarm_RegHaze/Stakeholder_Meetings.htm

- TCR's General Reporting Protocol:

<http://www.theclimateregistry.org/downloads/GRP.pdf>

- WCI:

<http://www.westernclimateinitiative.org/>



Contact Information

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Questions?